CLAIMS

1. A semiconductor device characterized by comprising

a semiconductor substrate made of SiC; and

an insulating film formed on said semiconductor substrate,

wherein said insulating film is formed by a plasma treatment and contains a rare gas at least partly.

2. A semiconductor device according to claim 1, characterized in that said insulating film includes a gate insulating film.

3. A semiconductor device according to claim 1 or 2, characterized in that said insulating film contains at least one of krypton (Kr), argon (Ar), and xenon (Xe) as the rare gas.

4. A semiconductor device according to any of claims 1, 2, and 3, characterized in that at least part of said insulating film is one of an oxide film, an oxynitride film, and a nitride film.

5. A semiconductor device according to any of claims 1, 2, 3, and 4, characterized in that SiC forming said semiconductor substrate is a single crystal.

6. A semiconductor device according to any of claims 1, 2, 3, 4, and 5, characterized in that said insulating film is formed by the plasma treatment where a temperature of the substrate is 600°C or less.

7. A semiconductor device according to any of claims 1, 2, 3, 4, 5, and 6, characterized in that said insulating film is formed by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma.

8. A semiconductor device according to any of claims 1, 2, 3, 4, 5, and 6, characterized in that said insulating film includes at least one of an oxide film, a nitride film, and an oxynitride film formed by microwave-excited plasma CVD.

9. A semiconductor device according to any of claims 1, 2, 3, 4, 5, and 6, characterized in that said insulating film includes at least one of an oxide film, a nitride film, and an oxynitride film formed by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma and then by microwave-excited plasma CVD.

10. A semiconductor device characterized by comprising

a semiconductor substrate made of single-crystal SiC; and

an insulating film including a gate insulating film formed on said semiconductor substrate,

wherein said insulating film is formed by a plasma treatment,

said insulating film contains at least one of krypton (Kr), argon (Ar), and xenon (Xe) as a rare gas,

at least part of said insulating film is one of an oxide film, an oxynitride film, and a nitride film, and

said insulating film is formed by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma under a condition where a temperature of the substrate is 600°C or less.

11. A semiconductor device characterized by comprising

a semiconductor substrate made of single-crystal SiC; and

an insulating film including a gate insulating film formed on said semiconductor substrate,

wherein said insulating film is formed by a plasma treatment,

said insulating film contains at least one of krypton (Kr), argon (Ar), and xenon (Xe) as a rare gas,

at least part of said insulating film is one of an oxide film, an oxynitride film, and a nitride film, and

said insulating film is formed by one of oxidation, nitriding, and oxynitriding by microwave-excited plasma CVD under a condition where a

temperature of the substrate is 600°C or less.

12. A semiconductor device characterized by comprising

a semiconductor substrate made of single-crystal SiC; and

an insulating film including a gate insulating film formed on said semiconductor substrate,

wherein said insulating film is formed by a plasma treatment,

said insulating film contains at least one of krypton (Kr), argon (Ar), and xenon (Xe) as a rare gas,

at least part of said insulating film is one of an oxide film, an oxynitride film, and a nitride film, and

said insulating film is formed, under a condition where a temperature of the substrate is 600°C or less, by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma and then by one of oxidation, nitriding, and oxynitriding by microwave-excited plasma CVD.

13. A semiconductor device manufacturing method characterized by forming an insulating film by a plasma treatment on a semiconductor substrate made of SiC.

14. A semiconductor device manufacturing method according to claim 13, characterized in that said insulating film includes a gate insulating film.

15. A semiconductor device manufacturing method according to claim 13 or 14, characterized by using at least one of krypton (Kr), argon (Ar), and xenon (Xe) as a rare gas when forming said insulating film.

16. A semiconductor device manufacturing method according to any of claims 13, 14, and 15, characterized in that at least part of said insulating film is one of an oxide film, an oxynitride film, and a nitride film.

17. A semiconductor device manufacturing method according to any of claims 13, 14, 15, and 16, characterized in that SiC forming said semiconductor substrate is a single crystal.

18. A semiconductor device manufacturing method according to any of claims 13, 14, 15, 16, and 17, characterized by forming said insulating film by the plasma treatment where a temperature of the substrate is 600°C or less.

19. A semiconductor device manufacturing method according to any of claims 13, 14, 15, 16, 17, and 18, characterized by forming said insulating film by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma.

20. A semiconductor device manufacturing method according to any of claims 13, 14, 15, 16, 17, and 18, characterized in that said insulating film is one of an oxide film, a nitride film, and an oxynitride film formed by microwave-excited plasma CVD.

21. A semiconductor device manufacturing method according to any of claims 13, 14, 15, 16, 17, and 18, characterized in that said insulating film is one of an oxide film, a nitride film, and an oxynitride film formed by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma and then by microwave-excited plasma CVD.

22. A semiconductor device manufacturing method for forming an insulating film including a gate insulating film by a plasma treatment on a semiconductor substrate made of single-crystal SiC, said method characterized by

using at least one of krypton (Kr), argon (Ar), and xenon (Xe) as a rare gas when forming said insulating film,

at least part of said insulating film being one of an oxide film, an oxynitride film, and a nitride film, and

forming said insulating film by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma under a condition where a temperature of the substrate is 600°C or less.

23. A semiconductor device manufacturing method for forming an insulating film including a gate insulating film by a plasma treatment on a semiconductor substrate made of single-crystal SiC, said method characterized by

using at least one of krypton (Kr), argon (Ar), and xenon (Xe) as a rare gas when forming said insulating film,

at least part of said insulating film being one of an oxide film, an oxynitride film, and a nitride film, and

forming said insulating film by one of oxidation, nitriding, and oxynitriding by microwave-excited plasma CVD under a condition where a temperature of the substrate is 600°C or less.

24. A semiconductor device manufacturing method for forming an insulating film including a gate insulating film by a plasma treatment on a semiconductor substrate made of single-crystal SiC, said method characterized by

using at least one of krypton (Kr), argon (Ar), and xenon (Xe) as a rare gas when forming said insulating film,

at least part of said insulating film being one of an oxide film, an oxynitride film, and a nitride film, and

forming said insulating film, under a condition where a temperature of the substrate is 600°C or less, by one of direct oxidation, direct nitriding, and direct oxynitriding of a microwave-excited plasma and then by one of oxidation, nitriding, and oxynitriding by microwave-excited plasma CVD.